

with temperatures of 90° or higher and 100° or higher than in any previous year.

In 1910 the precipitation was the least ever recorded at Dodge City, equaling the dry year of 1893, when the total was 10.12 inches. Notwithstanding the great deficiency in precipitation, Ford County in 1910 had the largest and best paying wheat crop in its history and was among the first five counties in Kansas in wheat production. The unusually large wheat crop for that year can be attributed to the unprecedented precipitation and abnormally high temperature of November, 1909, and the severely cold December following. Up to the time of the remarkably heavy rain, sleet, and snow storm of the latter part of November, it had been unusually warm, and the ground was not frozen when the heavy precipitation occurred, which in four days amounted to 4.19 inches. Owing to the condition of the soil, nearly all of this precipitation was stored up, very little of it having been lost by evaporation. Immediately following this heavy precipitation unusually cold weather set in, December of that year being the second coldest of any December since the establishment of this station.

Prior to 1900 this section was not engaged in agricultural pursuits to any great extent. The acreage under cultivation in 1901 was not over a fourth of the acreage in winter wheat in 1913 and consequently the loss could not have been nearly as great.

While nearly all of the streams are dry at this writing, September 11, yet the supply of water from the underflow is abundant for present and future needs of man and beast. The city waterworks is pumping about 15,000 gallons of water per minute, which is, and has been, ample for all purposes. The wells will supply sufficient water for the stock during the coming winter.

The general health in this community has been good; there have been no epidemics, and sickness has probably been less than in previous years.

In addition to the damage done by the drought considerable damage was done by grasshoppers during July and the early part of August, and on the whole the droughts of 1913 have generally been considered by the oldest residents of this vicinity to have been the worst ever experienced.

#### NOTES ON THE HEAT AND DROUGHT OF THE SUMMER OF 1913 AT IOLA, KANS.

By H. K. HOLCOMB, Observer.

The drought and heat wave of the present year continued from July 25 to September 8, inclusive, in this vicinity. During this period the light showers which occurred were of no material benefit and the few days when the temperature fell below normal gave only temporary relief.

The mean temperature for the period of 46 days drought was 84, being an average daily excess as compared with the normal of 8°, and the accumulated excess in temperature for the period amounted to 368°. On 30 days of the period the mean temperature was above normal, and on 23 days the temperature attained a maximum of 100° or above, reaching an absolute maximum of 105° on August 6. The total precipitation for the period was 0.35 inch, and the accumulated deficiency amounted to 4.86 inches. On 35 days of the period southerly winds prevailed.

Preceding the drought this year there was an accumulated deficiency in precipitation of 3.14 inches,

which accounted for the comparatively small supply of underground water.

The drought destroyed pastures for the remainder of the season, reduced the corn in this vicinity to one-fourth of a crop, the hay to half of a crop, and the late vegetables to one-fourth of a crop. Wheat was not damaged, as that crop was matured before the drought became effective, and early vegetable crops were uninjured. The drought diminished the stock water until the supply on uplands was exhausted and many persons were compelled to haul water several miles for household and stock purposes. The volume of water stored by dams in the Neosho River would last for several months longer should no rain fall during that time. Dryness caused many cracks extending down 3 or 4 feet in the soil. Along the railroads the cracks in the ground caused sink holes and necessitated frequent repairing of the ballast. The dryness of the soil prevented plowing, and deferred the sowing of alfalfa and wheat, and the excessive heat interfered to some extent with construction work. In several localities shallow rooted shade trees died from absence of moisture in the soil. At the Iola Portland cement plant, having a capacity for producing 5,000 barrels of cement daily, the water supply stored at the regular intake became exhausted, which necessitated laying a pipe line to the Neosho River. The excessive heat also interfered with the working of the engines, causing shutdowns and repairs, and an extra force of laborers had to be employed in the mill and kiln rooms.

#### NOTES ON THE DROUGHT AND HEAT DURING THE SUMMER OF 1913 AT WICHITA, KANS.

By H. P. HARDIN, Observer.

Judged by the climatological data available here and the reminiscence of the oldest settlers, the 1913 drought was beyond question the most severe and caused a greater crop loss than any other drought of which we have a record or tradition.

Of the years covered by the records of this office, 1888-1913, those showing droughty conditions are:

In 1890, from June 20 to August 22, there was but 2.17 inches of rainfall, 0.01 inch or more occurring on 10 days. The mean maximum temperature was 93°, the highest 102°, and 100° or more occurred on 7 days.

In 1893, from August 1 to September 18, the total precipitation was 1.51 inches. This amount fell in showers on 8 days in August. The highest temperature was 104°, and 100° or more occurred on 2 days. This is referred to by those who went through it as a very disastrous drought.

In 1897 a drought began with May 14 and continued until August 2. In that period showers on 3 days totaled 0.64 inch in May; on 11 days, 1.99 inches in June; and on 9 days, 1.49 inches in July. June 16 a heated period began, and on August 3, when the drought was broken, there had been 48 days of insufficient precipitation, having maximum temperatures averaging 95°, and reaching 100° to 102° on 10 days. This is referred to as a crop-failure year, but the census report shows that considerable agricultural products were marketed.

In 1901 there was practically no rain, only 0.22 inch from June 20 to July 17. The daily maximum temperatures averaged 98°; 100° or more occurred on 11 days, and during the last 11 days of the drought the maximum temperatures ranged from 99° to 103°, the latter occur-

ring on two successive days. Good rains during the remainder of the season prevented a crop failure. This year approaches the nearest to 1913 in point of temperature records. The heat wave coming as it did at the most critical period in the life of the corn plant, that crop was seriously injured, and forage, truck, and fruits are said to have been cut 50 per cent by the withering hot winds. Live stock was not materially affected.

The drought of 1910 is the nearest parallel in point of duration to that of 1913. It began with the new year and continued through July, relieved somewhat by heavy rains in the first half of May and showers in the first decades of June and July. The total precipitation was 3.72 inches, distributed in showers on 20 days. Temperatures were normal until July 23. On that date 104° was recorded and on the 5 succeeding days 103° to 105°, the latter occurring on two dates. Crops were seriously damaged, and in many individual instances single staples were a total failure; and as a whole, the agricultural output was not profitable to the farmers.

Nineteen hundred and eleven also began with droughty conditions existing. Heavy snowfalls in February and near the normal rainfalls in April and May relieved the crop situation materially. The total absence of precipitation in the months of March and June aided by high temperatures in the last decade of June cut all crop yields. On June 25 107° occurred, establishing a new high temperature record for the station which has not since been broken.

The 1913 drought began with a 47 per cent precipitation deficit in January, followed by deficiencies of 87 per cent in March, 32 per cent in April, 80 per cent in May, 71 per cent in June, 65 per cent in July, 100 per cent through August to September 5, when the drought was broken. The effect of the shortage of precipitation is increased or diminished by the excess or deficiency of temperature, clear skies, and dry-air movements, and all of these elements were progressively above normal through the spring and summer months. July and August were the most trying months. In July the monthly mean maximum temperature was 93°, the highest 102°; 90° or above on 22 days, and 100° or more on six days. There were 20 clear days, 10 partly cloudy and 1 cloudy day. The daily hours of sunshine ranged from 52 per cent on 1 day to 100 per cent on 11 days and averaged 87 per cent of the possible hours. Winds prevailed from the south with a total movement of 9,975 miles which is 3,000 miles above the July average and 337 miles more than was ever recorded in July previously.

August passed without relieving the droughty condition. Instead, the month was the driest and hottest of any August of which we have a record. No measurable precipitation occurred, and excessive heat, sunshine, drying winds, and a marked absence of atmospheric humidity accentuated the need of rain. No other August has been without rainfall, and our records indicate that no other month in the history of the station has had such prolonged high temperature and number of days with low humidity and clear skies. The daily maximum temperatures averaged 98°, the highest was 104°; 90° and over occurred on 30 days, and 100° and above on 12 days. There were 27 clear days and 4 partly cloudy. The daily hours of sunshine ranged from 63 per cent on 1 day to 100 per cent on 17 days, and averaged for the month 95 per cent of the possible hours. The winds prevailed from the south with a total movement of 9,113 miles which is 3,274 miles more than the average for August. The relative humidity ranged from 8 per cent to 78 per cent and averaged 38 per cent.

Rains in September and October, 1912, and a covering of snow during the severest weather through the winter brought winter wheat to March in the best condition ever known in this section; and the drought in March did not injure it. In April there was precipitation enough to prevent deterioration. Estimates of a bumper yield were made. Insufficient precipitation and high, drying winds through May caused wheat to burn badly during the three days of excessive high temperature at the end of that month. The berry was then in milk; moisture and mild temperature were necessary to its development. When harvesting began in June many fields had not enough berry to pay for cutting and thrashing, and were burned over to prepare the ground for another crop. However, enough wheat had been sown on ground having good drought-resisting qualities to bring the aggregate yields to within one-third of the average for this (Sedgwick) county. The authentic estimates for this county and those adjoining are wheat, 77 per cent; oats, 36 per cent; corn, no grain of importance, but more than the average went into silos while still green and about 10 per cent of fodder; alfalfa hay, 33 per cent; seed, much more than normal; wild hay and pastures practically failures; berries and fruit, except apples, total failures; enough of the orchards were irrigated to save 25 per cent of the apples, but this fruit will be of poor quality. Produce dealers say egg deliveries fell off 90 per cent, young poultry 50 per cent, while old stock was thrown on the market to such an extent that the winter supply will have to be imported. Horses are "off" 20 per cent to 35 per cent, and all that can possibly be spared from the farms are being sold to avoid wintering. Food animals were marketed before the scarcity of feed became acute and while they were in condition, in anticipation of a feed famine. In many cases the stockers were disposed of, too, but some stockmen held theirs until they could not feed them another day. It was stated that some of these latter reached the local stockyards practically "down," nothing but skin and bones. As a rule, these same stockers brought more money per pound, though less per head, than the better-conditioned ones, being capable of taking on more pounds when transported to States where feed was plentiful. The price of food animals did not break, and the market quotations indicate good business. Feed became too high for most dairymen to profitably purchase, and some herds were sold, the prices, as a rule, being considerably under their values. The Wichita Beacon features a column of "Stockyard gossip" by a specialist in that line. The following is from a recent issue, and fairly represents the crop and stock situation in this section. Bentley is in this (Sedgwick) county; Haven is in Reno County:

F. Scott, of Haven, brought in a load of cattle and a load of hogs. Both are getting scarce. There are not many shoats and some are letting them go. Some farmers lack feed, having sold their wheat early in the season. They have a little corn fodder, some of which is in silos. Wheat straw will be their chief roughness. They have not begun feeding ensilage. Alfalfa is selling at \$16 to \$17 a ton.

John Williams, of Bentley, brought in hogs. They raised no wheat at Bentley, and as the corn has failed they have no feed. There is a large acreage of corn fodder, mostly in shock, but some in silos. It will be a close rub to winter their stock without shipping in something. They had but one citting of alfalfa. They are selling off their shoats, but holding on to milch cows.

In the Arkansas Valley where the underflow is available pumping outfits were put in and there was never any danger of a water famine. Surface ponds dried up early in the season, and later, springs and deep wells that had lived through former droughts failed, and in some cases would not respond to "shooting" with dyna-

mite or deeper boring, but these were outside the valley. In some communities water had to be hauled miles by team or rail. But there was never a serious water shortage for human beings and a limited number of live stock in any community. The shortage of pasture and the certainty of high feed started cattle to market before wells failed, and the crop failure sent in the others about the same time that stock water for large bunches of cattle failed. Cattle died for water in a number of instances when the well or windmill failed to supply them as usual. But in every investigated case other water could have been procured in time had those in charge of the cattle visited them often enough to properly guard their trust.

The effect of the drought will not be as disastrous economically as previous ones, although it came as a climax to three successive years of poor crops, and more capital was involved in this than in any other. People seem to have confidence in the land as a source of wealth, and enough of them have resources they have created with money taken from the soil to keep the farms and businesses going until bountiful crops are made. There will be no more than normal emigration, and probably less of the movement from the farm to the city because there will be less opportunities in the cities until the farms are prosperous again.

#### **DROUGHT OF THE SPRING AND SUMMER OF 1913 AT COLUMBIA, MO.**

By GEORGE REEDER, Section Director.

At the close of April, 1913, the excess in precipitation for the first four months of the year was 2.19 inches, but by the close of the following month this excess had been cut down to a deficiency of 1.24 inches. It may be said that the drought in this vicinity began about the middle of April, as there was but one light shower after the 13th. The dry and sunshiny weather that prevailed during the latter part of April, however, was just the kind of weather needed, as there had been, owing to much moisture, little or no farm work done up to that time. The drought, though, steadily increased during May and June, and after becoming somewhat modified during July, culminated in one of the most disastrous droughts ever known here in the month of August and the first 10 days of September.

The showers in May were frequent, but they were too light to make the hay crop, which requires considerable moisture during this month. A short period of showers during the third week of June gave temporary relief, but the month closed with a total deficiency of 3.22 inches. The first half of July, on the other hand, gave frequent showers and a few good rains, the total for the month being 3.38 inches, which is only 0.27 inch below normal. About this time—the middle of July—the outlook had improved, and the community awaked to renewed optimism. The corn condition had improved, as well as pastures. But this pleasing outlook did not last long. On or about July 20 the drought set in again and a few days later, increasing heat; and from that time to the 10th of September, 53 days, only 0.93 inch of rain fell, 0.77 inch of this amount falling in August. The lack of moisture was, of course, intensified by excessive sunshine and high temperature.

The most harmful effects of the drought were that the hay and potato crops, as well as gardens and pastures,

were reduced to nearly total failures, ponds dried up, corn was seriously damaged, and fall farm work was delayed.

In regard to a more concise opinion of the harmful effects of the drought, Prof. F. B. Mumford, director of the local experiment station, has kindly furnished the following information:

The drought has been severe on upland soils of this county. The season has been very favorable for the maximum production of corn on the bottom lands in Boone County. It is difficult to estimate the actual cash damage to staple crops, but I am of the opinion that the yields on the uplands in this county will not be larger than one-third of a crop secured in a good corn year. The hay crop was very light, and the pastures have not been able to carry more than one-third or one-half as many animals during the present season as carried in an ordinary season. The general results of the very dry season and unusual hot weather have dried up the water holes upon which farmers have depended for stock water, and this, with the scarcity of feed, has compelled a large number of farmers to dispose of their stock cattle, sheep, and hogs, and also, what is still more serious, to dispose of breeding animals to a considerable extent. How great this loss is, it is difficult to estimate.

It is reported that the apple crop is seriously affected, and even the forest trees have dropped more than half their leaves, the ground being covered with them as much as one observes in late October.

#### **THE HEAT AND DROUGHT OF 1913 AT HANNIBAL, MO.**

By B. L. WALDRON, Local Forecaster.

The heat wave of 1913 was remarkable for its long duration and the very short periods of relief. It began on May 28 and from that time to September 7, a period of 103 days, there were but 21 days with the temperature below normal. There were 69 days with maximum temperature of 90° or above, and 9 days with a maximum of 100° or over, the highest being 103° on August 7. The average daily excess above the normal was 4.8°. The record of high temperatures by months was equaled in May and September and exceeded in August.

While the mean for the three summer months was not as high as in 1901, yet the mean for July and August combined was higher than during any previous year.

The relative humidity was much below normal, and it is believed there was less suffering from the heat than often occurs with lower temperatures, reports indicating that there were no deaths from heat and only one or two prostrations from that cause.

The summer of 1913 was the driest since the local office was established in 1892. The drought began April 10 and from that time to September 9 there were only two rains that exceeded one-half inch, and but one that exceeded 1 inch. During these 5 months there was a total rainfall of only 5.19 inches, and the accumulated deficiency for that period amounted to 13.87 inches. The drought of 1901 began April 7 and for the 5 months ending September 6 there was a total rainfall of 7.41 inches.

From information at hand it appears that crops are better this year than in 1901. This is probably accounted for, in part at least, by the fact that when the present drought commenced the ground was well saturated with water. Cultivation began as soon as the ground was dry enough and continued until the size of the growing crops prevented further working. In 1901 the winter had been excessively dry and the spring rains were only moderate.